LA Techniques Ltd

LA19-14-06B 6 GHz Vector Network Analyser

Overview and Data Sheet

The LA19-14-06 is a 6 GHz (usable to 6.4 GHz) USB controlled, handheld Vector Network Analyser capable of providing professional performance and capability at an unmatched level of affordability. It supports S11 and S21 measurements of both magnitude and phase.

The LA19-14-06 uses a single board design in order to provide a uniquely affordable solution which nevertheless includes a unique on-board electronic calibrator that can be used to store calibrations and improve the instrument's temperature performance. The instrument also offers exceptionally low trace noise of the order of 0.006 dB rms at its maximum operating bandwidth of 140 kHz, a maximum measurement speed of 100 µs per point for S11 measurements and 10 Hz frequency setting resolution. All of this in a compact, handheld package.

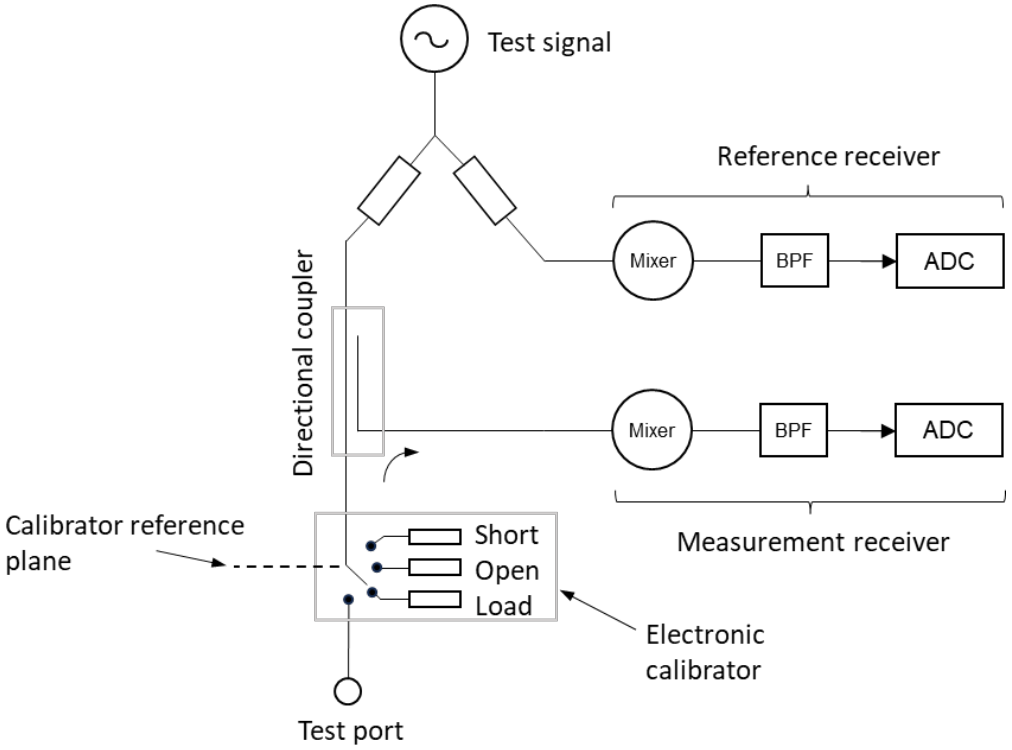
The LA19-14-06 can be supported by most commercially available calibration kits as well as LA Technique's precision PC3.5 calibration kits and Easy-Cal electronic calibration module.

S11 and S21 Vector Measurements

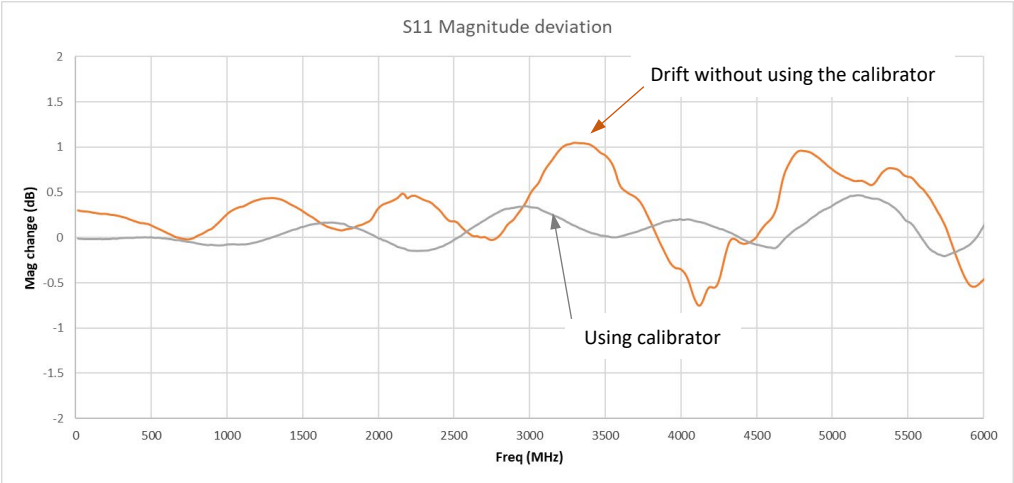
- Fast speed of 100 µs per frequency point for S11 measurements
- Compact, USB powered design
- Network de-embedding and reference plane extension
- Unique on-board calibration storage helps to combat temperature drift
- Unique Save on Trigger facility allows capture of over 1000 sweeps
- Time domain transmission and reflectometry
- EasyCal Electronic calibration module support
- Control via user interface, API or SCPI
- Signal generator (CW and frequency sweep) utility

Internal Calibration Store Using a Built-In Electronic Calibrator

In the LA19-14-06 VNA, temperature drift in reflection coefficient (S11) measurements is significantly reduced by a novel technique of storing and retrieving calibrations. This uses a built-in electronic calibrator to store and instantly retrieve calibrations. It operates by measuring and storing the reflection coefficient of built-in Short, Open and Load standards. Restoring a calibration works by re-measuring the same standards and computing the corresponding error terms. The technique is particularly useful for field use where operation over a wide temperature range is likely, but of course, it will also benefit indoor use by providing near instant calibration immediately after power on.



The built-in electronic calibrator (shown above) helps to reduce S11 measurement temperature drift. An example of a -12dB S11 measurement is shown below, with the maximum drift is kept to below 0.5 dB with a 22ºC temperature change.

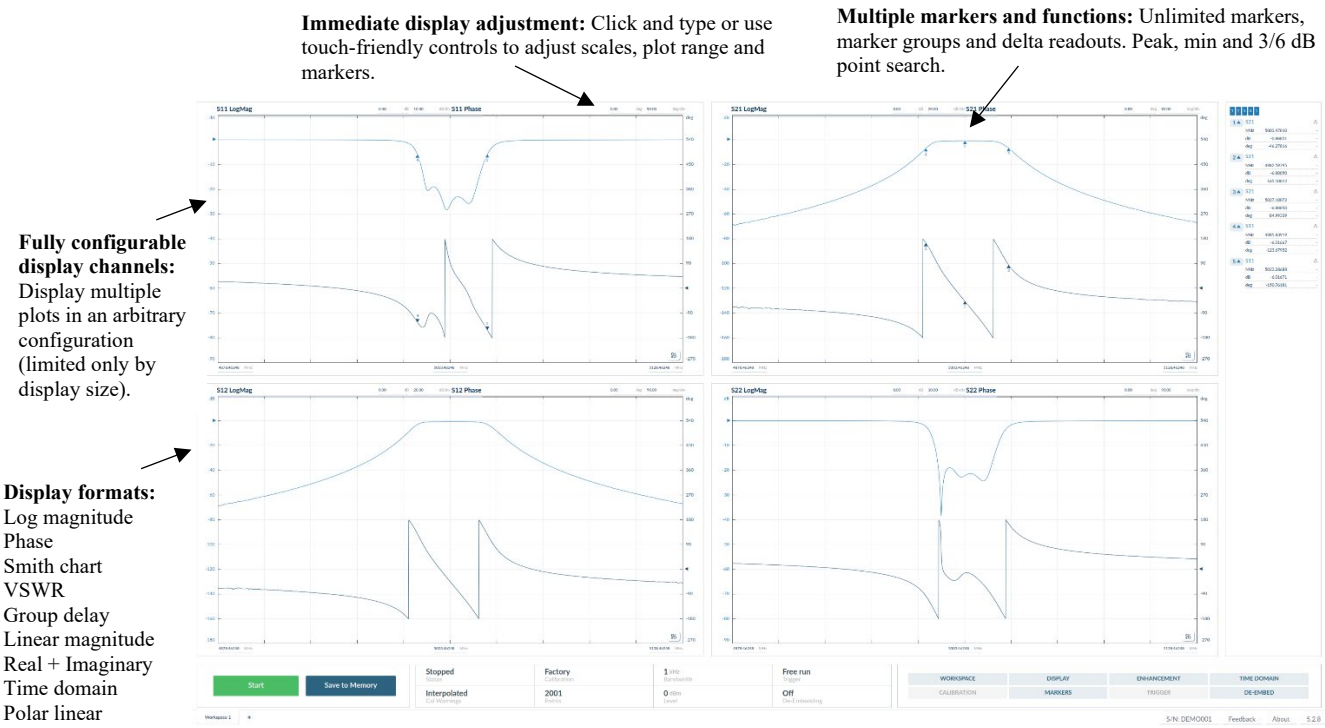


Relative measurement drift following a 22ºC case temperature change

Comprehensive and easy to use software

The *VNA Control 5* user interface software was developed by experienced users of VNAs with ease of use being the key driver. The main tasks such as calibration, display set up and measured data saving are simple and straightforward to carry out.

The LA19-14-06 is ideal for a range of applications including field service, installation, research and development, production, and classroom applications. With its support for remote automation, the LA19-14-06 can also be used for ATE applications.



Reference plane extension (manual and automatic) together with network de-embedding provide very useful aids to measurement of, for example, surface mount components.

LA Techniques have been designing and manufacturing USB driven VNAs for close to 20 years and all versions of the software have included a simple to use calibration kit editor. The editor with the LA19-14-06 allows for very quick creation of calibration kits from either model data or measured data. This versatility allows kits to be created for most commercially available calibration kits. Using the editor, the user can also quickly create “clone” kits from precision kits using low cost parts.

Other useful utilities include Data Compare (compares measured data with reference data loaded from disk), and a signal generator function able to operate in CW or frequency sweep modes. Sweep plans of up to 10,001 points are allowed with adjustable dwell times of between 250 µs and 60,000 µs.

Specification

The instrument's specification is given below. Unless otherwise stated, the figures apply with a 1 kHz resolution bandwidth, at -3 dBm test power using a S11+S21 calibration (including isolation calibration) with no averaging and no interpolation and at an ambient temperature of between 15°C and 30°C but within 1°C of the calibration temperature and at least 30 minutes after power up. Where applicable, the figures apply to the use of LA's calibration kits DW97157 Iss.2.0 and DW97158 Iss.2.0 or better kits.

Receiver Characteristics

Measurement Bandwidth (Hz):
140 k, 70 k, 35 k, 15 k, 10 k, 5 k,
1 k, 500, 100, 50, 10

Dynamic Range, measured after an S11+S21 calibration (with 0 dBm level) with ports terminated in 50Ω. The table shows the S21 noise floor in dB.

Band (MHz)	Typical	Max
0.3 - 2000	-80	-66
2000 – 6000	-70	-50

Dynamic range is limited by crosstalk.

Temperature stability, measured after an S11 calibration and with test port shorted, typical:

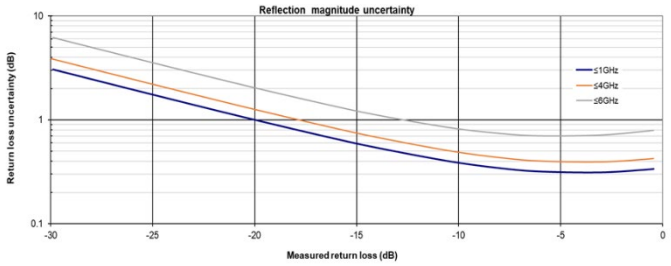
0.03 dB/ ° C for F < 4GHz
0.05 dB/ ° C for 6GHz ≥ F ≥ 4GHz

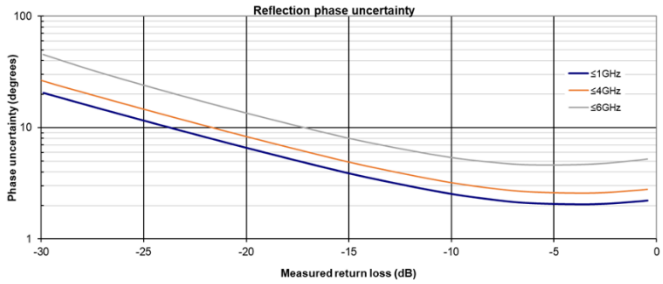
Trace noise, dB rms, measured using a 201 points sweep plan covering 0.3MHz to 6GHz and test power set to 0dBm

Bandwidth	Typical	Max
10kHz	0.002	0.004
70kHz	0.004	0.006
140kHz	0.008	0.012

Measurement Uncertainty

In addition to the conditions outlined earlier in this section, the S11 figures apply for a single port DUT and S21 apply for a DUT having S11 and S22 = 0.





Transmission uncertainty

Range	Magnitude	Phase
-20 dBm to +3 dBm		
Freq < 2MHz	1.0	8º
Freq ≥ 2MHz, ≤ 6000MHz	0.6	6º
-40 dBm to -20 dBm		
Freq < 2MHz	1.2	10º
Freq ≥ 2MHz, ≤ 6000MHz	1.8	14º

Test port characteristics

Load match (port 2)
< 26 dB, typical

Source match (port 1, f ≤ 6GHz)
Uncorrected: 15 dB, typical
Corrected: 45 dB, typical
30 dB, min

Directivity
Corrected: 47 dB, typical
36 dB, min

Crosstalk
Corrected, measured with both calibrated ports terminated in short circuits after isolation calibration over band specified.

Band	Typical	Max
0.3MHz – 2GHz	-80	-66
2GHz – 6GHz	-70	-50

Maximum input level
0.1 dB compression: 0 dBm, typ

Maximum input level
No damage: +27 dBm

Test port connectors
Type N, female

Sweep trigger output voltage
Low: 0 V to 0.8 V
High: 2.2 V to 3.6 V

Sweep trigger input voltage
Low: -0.1 V to 1 V
High: 2.0 V to 4 V

Sweep trigger input voltage
No damage: ±6 V

Sweep trigger in/out connectors
BNC, female on back panel

Measuring functions

Measuring parameters
S11, S21

Error correction

S11 (1 port correction)

S21 (source match correction + normalise + isolation)

Averaging, smoothing

Hanning and Kaiser Bessel filtering on time domain measurements,

electrical length compensation (manual), electrical length compensation (auto),

effective dielectric constant correction

Display channels
4 channels

Traces
2 traces per display channel

Display formats
Amplitude (logarithmic and linear)
Phase, Group Delay, VSWR, Real, Imaginary, Smith Chart, Polar, Time Domain

Memory trace
One per display channel

Limit lines
6 segments per channel (overlap allowed)

Markers
8 markers

Marker functions
Normal, Δ marker, fixed marker, peak / min hold, 3 dB and 6 dB bandwidth

Sweep functions

Sweep type
Linear sweep
CW sweep (timed sweep)

Sweep times
140 kHz bandwidth
10 MHz to 6.4 GHz sweep
201 points (S11): 20.2ms
201 points (S11+S21): 33.1ms

Number of sweep points
51, 101, 201, 401, 801, 1024, 2001, 4001, 9001, 10001

Signal Source Characteristics

Frequency range:
300 kHz to 6.4 GHz

Frequency setting resolution:
10 Hz

Frequency accuracy:
with ambient of 23 ±3 ºC
10 ppm max

Frequency temperature stability:
±0.5 ppm/ºC max over the range +15 ºC to +35 ºC

Harmonics:
With test power set to < -3 dBm
-20 dBc max

Non-harmonic spurious:
-40 dBc typical

Phase noise (10 kHz offset, typ.):
-80 dBc/Hz [0.3 MHz to 1 GHz]
-60 dBc/Hz [1 GHz to 4 GHz]
-57 dBc/Hz [> 4 GHz]

Test signal power:
+0 to -20dBm

Power setting resolution:
0.1dB

Power setting accuracy:
±1.5 dB

Reference input frequency:
10 MHz ±6 ppm

Reference input level:
0 ±3 dBm

Reference output level:
0 ±3 dBm

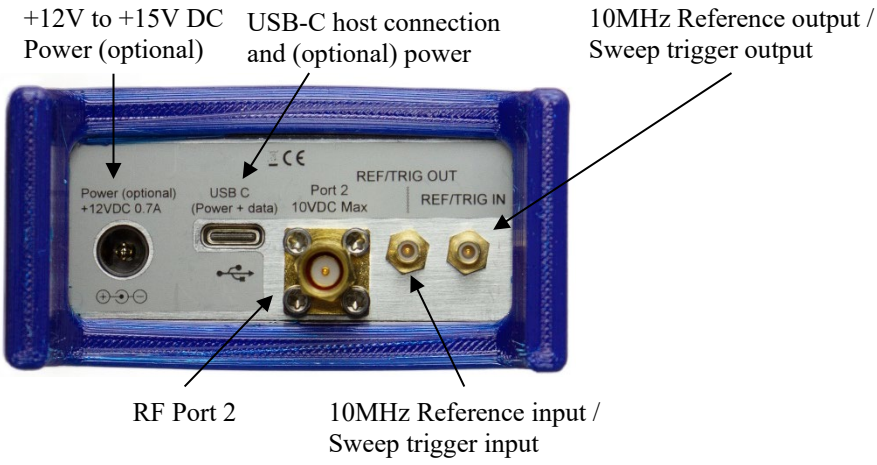
Top panel and status LED

Status LED red: powering up
Status LED green: ready

Front panel

Front panel consists of a single N-type connector (male).

Rear panel connections



Miscellaneous

Controlling PC data interface:
USB C

Support for third party test software:
Standalone API with examples in C, C++ and Python
SCPI remote interface (via *VNA Control 5*)

External dimensions (mm):
286 x 174 x 61 (L x W x H)
Excluding connectors

Weight:
2.1 kg

Temperature range (operating):
0 ºC to +40 ºC

Temperature range (storage):
-20 ºC to +50 ºC

Humidity:
80% max, non-condensing

Vibration (storage):
0.5G, 5 Hz to 300 Hz

Power source and current:
+12 Vdc to +15 Vdc, 1.9A max with +15 Vdc supply.

Power source connector:
5.5 mm diameter hole, 2.1 mm diameter centre contact pin. Centre pin is positive.

Host requirements:
Linux, Microsoft Windows© 10 or later, macOS 11 (Big Sur) or later, Raspberry Pi 4 or later.
2 GB RAM or more.
Screen resolution 1680x1050 or higher.
A high-performance graphics card is recommended for larger (>1001 points) sweep points.

Ordering information

Please contact sales@latechniques.com for any queries or to place an order.